CLAIMS

What is claimed as invention is:

1. An improved injection-molding holding furnace having an adjustment apparatus for independent and selective positioning of resistance heating elements, said furnace comprising:

a steel case (12) having a liner (14) encasing a reservoir (16) for holding molten metal (18), said furnace being hermetically sealed and having a pressure-tight lid (22) at its top having at least one aperture (26) for the insertion of at least one feed tube (20) which extend(s) downward through said lid and into said furnace reservoir (16), and at least one heating element access door (30);

a plurality of elongate electrical resistance heating elements (28) installed through said access door (30), disposed horizontally above said reservoir (16), each of said heating elements supported at each end in a corresponding movable heating element box (32), each of said heating elements having an unshielded portion (34) for the introduction of heat into said reservoir; and

adjustment means connected to said heating element boxes for independent and selective positioning of said resistance heating elements.

2. The improved injection-molding holding furnace of claim 1, wherein said heating elements are elongate.

3. The improved injection-molding holding furnace of claim 1, wherein said adjustment means comprises a plurality of rack and pinion gear sets, one set each dedicated to one heating element of said plurality of said heating elements.

4. The improved injection-molding holding furnace of claim 3, wherein said rack and pinion gear sets are parallel.

5. The improved injection-molding holding furnace of claim 4, wherein said rack and pinion gear sets are vertically stacked and further including a pinion gear assembly housing (40).

6. The improved injection-molding holding furnace of claim 5, wherein said vertically stacked pinion gear sets include a middle rack set (44a), a lower rack set (44b), and an upper rack set (44c), and said furnace has three heating elements and three sets of heating element boxes, including proximate heating element boxes (32a) most proximate said pinion gear assembly housing and connected to said middle rack set (44a), and distal heating element boxes (32b, 32c), coupled to said upper and lower rack sets, respectively.

7. The improved injection-molding holding furnace of claim 5, wherein each member of said pinion gear sets is positioned on opposite sides of said furnace, and each rack and pinion set is coupled at one end to one of said heating element boxes.

8. The improved injection-molding holding furnace of claim 5, further including synchronizing means to provide synchronous movement of member of said rack and pinion sets.

9. The improved injection-molding holding furnace of claim 8, wherein said synchronizing means comprises timing shafts (46) disposed between each member of each set of rack and pinion gear sets.

10. The improved injection-molding holding furnace of claim 5, further including tuning means for fine-tuning the position and relationship of said heating elements.

11. The improved injection-molding holding furnace of claim 10, wherein said tuning means comprises an adjustment shaft (50).

12. The improved injection-molding holding furnace of claim 1, wherein said adjustment means comprises a timing chain drive assembly having parallel timing chains (60, 62, 64), each of said chains in mesh communication with a corresponding pinion gear (68,70, 66) and connected to one of said heating element boxes, each of said timing chains dedicated to actuating the movement of a respective heating element.

13. The improved injection-molding holding furnace of claim 12, further including a

timing chain housing (80).

14. The improved injection-molding holding furnace of claim 1, wherein said adjustment means comprises a screw drive assembly (90) having a plurality of acme screw and worm gear combinations, each of said combinations operatively connected to one of said heating elements.

15. The improved injection-molding holding furnace of claim 1, further including a sealed panel (24) affixed to said pressure-tight lid, said sealed panel having apertures through which said feed tubes extend.

16. An adjustment apparatus for independent and selective positioning of resistance heating elements in a pressurized metal injection-molding holding furnace having a reservoir for holding molten metal, a top having at least one aperture for the insertion of at least one feed tube which extends downward through said top and into the reservoir, and at least one heating element access door, said adjustment apparatus comprising:

a plurality of movable elongate electrical resistance heating elements installed through the access door and disposed horizontally above the reservoir, each of said heating elements supported at each end in a movable heating element box, each of said heating elements having an unshielded portion for the introduction of heat into the reservoir; and

heating element adjustment means for selectively and independently moving each of said heating elements relative to one another.

17. The adjustment apparatus of claim 16, wherein said heating element adjustment means comprises a plurality of rack and pinion gear sets, one set each dedicated to one of said plurality of said heating elements.

18. The adjustment apparatus of claim 17 wherein said rack and pinion gear sets are parallel.

19. The adjustment apparatus of claim 18, wherein said rack and pinion gear sets are vertically stacked.

20. The adjustment apparatus of claim 19, wherein said vertically stacked pinion gear sets include a middle rack set (44a), a lower rack set (44b), and an upper rack set (44c), and wherein said adjustment apparatus further includes three sets of heating element boxes, including proximate heating element boxes (32a) most proximate the pinion gears of said rack and pinion gear sets and connected to said middle rack set (44a), and distal heating element boxes (32b, 32c), coupled to said upper and lower rack sets, respectively.

21. The adjustment apparatus of claim 19, wherein each member of said pinion gear sets is positioned on opposite sides of the injection-molding holding furnace, and each rack and pinion set is coupled at one end to one of said heating element boxes.

22. The adjustment apparatus of claim 19, further including synchronizing means to provide synchronous movement of member of said rack and pinion sets.

23. The adjustment apparatus of claim 22, wherein said synchronizing means comprises timing shafts disposed between each member of each set of rack and pinion gear sets.

24. The adjustment apparatus of claim 17, further including tuning means for fine-tuning the position and relationship of said heating elements.

25. The adjustment apparatus of claim 24, wherein said tuning means comprises an adjustment shaft.

26. The adjustment apparatus of claim 16, wherein said adjustment means comprises a timing chain drive assembly having parallel timing chains, each of said chains in mesh communication with a corresponding pinion gear and connected to one of said heating element boxes, each of said timing chains dedicated to actuating the movement of a respective heating element.

27. The adjustment apparatus of 26, further including a timing chain housing.

28. The adjustment apparatus of claim 17, wherein said adjustment means comprises a screw drive assembly having a plurality of acme screw and worm gear combinations, each of said combinations operatively connected to one of said heating elements.

29. A method of selectively and independently moving electrical resistance heating elements in an injection-molding holding furnace, said method comprising the steps of:

providing a furnace having a steel case and an interior liner encasing a reservoir for holding molten metal, the furnace being hermetically sealed and having a pressure-tight lid at its top having at least one aperture for the insertion of at least one feed tube which extend(s) downward through the lid and into the furnace reservoir, at least one heating element access door, and at least one pair of movable heating element boxes for cradling electrical resistance heating elements;

providing a plurality of elongate electrical resistance heating elements and installing the heating elements through the access door such that the elements are disposed horizontally above the reservoir and are supported at each end in a corresponding movable heating element box; and

providing adjustment means connected to the heating element boxes for independent and selective positioning of the resistance heating elements.